The National Estuarine Research Reserve System

(NERRS)

The State of Estuarine Education: K–12 Needs Assessment

Executive Summary

Conducted by TERC

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Executive Summary

As part of its efforts to develop K–12 curriculum materials on estuaries, the National Estuarine Research Reserve System (NERRS) contracted with TERC, a non-profit educational research and development firm located in Cambridge, MA, to design and conduct a nation-wide needs assessment survey of the state of estuarine education.

Survey Design

The needs assessment was designed to answer three broad sets of questions:

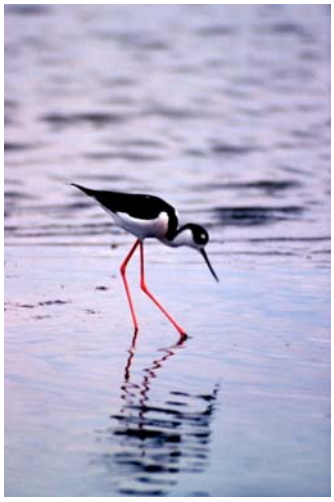
1) How can we characterize teachers who might teach about estuaries, the contexts in which they teach, and the general teaching methods they use?

2) How do estuaries, or topics related to estuaries, and teaching methods particularly suited to teaching about estuaries, fit with what teachers currently teach?

3) How can new estuarine-related curriculum materials and professional development be designed to increase the likelihood that they'll be used?

How did we collect data?

The survey was conducted online in both English and Spanish during the late winter and early spring, 2007. Participants completed an informed consent document before participating and were offered an opportunity to enter their name into a raffle for educationally-related prizes donated by a number of sponsoring organizations. During the 10 weeks that the survey was open for responses, 1342 people logged onto the survey, with 988 consenting and providing enough information to be included in the analysis of results; 414 people entered the drawing for the 118 prizes, which were delivered during June, 2007.



Findings

Who are the survey respondents?

- Survey respondents represent 47 of the 50 states, as well as Washington DC, Puerto Rico, Guam, and a few non-US sites. They work with a range of urban, suburban and rural students, in both coastal (47%) and non-coastal (53%) counties (just slightly more coastal than the US as a whole).
- Respondents represent a range of contexts, (85% in schools, 12% in informal education settings, and a few others), a range of grade levels (High school (40%), middle school (40%) and elementary grades (20%)) and a range of major content topics (biology, environmental science, and Earth science are most common, though others are represented, and the proportion of these vary by context and grade level).
- The racial and ethnic backgrounds of respondents' students are roughly comparable to the US as a whole, as are their students' economic resources as measured by free or reduced lunch statistics. Respondents may work with a somewhat higher percentage of English Language Learners than the US average.
- Respondents are 78% female, overall, and most have a Masters degree, a science degree, and are certified to teach, though all these percentages vary by teaching context and grade level taught. On average, respondents have been teaching for nearly 14 years, 12 of these teaching science.

Resource availability

The amount of available teaching time, access to the outdoors, and access to computers act as resources and/ or constraints on the kinds of curriculum activities teachers are able to do with their students.

- Median class size for needs assessment respondents is 25, with a median class length of 52.5 minutes, though both of these vary by teaching context and grade level. About half of informal educators, but only 18% of those in schools have longer "lab" classes available—again this varies by grade level taught.
- There are differences by context in how often teachers bring students outdoors—potentially an important resource in exploring natural areas. Informal educators take students outdoors an average of once or twice a

week; those in schools only take students outdoors an average of once or twice a year.

- Use of real-time data through NOAA's System Wide Monitoring Program (SWMP) is another potential resource, but only possible for those educators who have access to computers and the Internet. Most school teachers (82%) have access to computers in their classroom or a lab, and most of these (86%) have access to the Internet. Most school teachers (74%) also have access to data analysis software. All these resources are much less available in informal education contexts.

Current general teaching methods and sources of materials

New curriculum materials are more likely to be adopted if they fit broadly into the time frames, types of classroom activities, and typical formats and sources used by teachers.

- When considering adopting new curricula, the vast majority of educators across all settings prefer curriculum materials presented in relatively short timeframes—individual activities, one week or less of connected activities, or one 2 to 3 week module. However, nearly 2/3 of educators in most settings say they might use several modules, and nearly half say they might use a full semester of materials.
- A number of types of activities that might be incorporated into innovative curriculum materials are currently frequently used by teachers. In particular, hands-on activities, student problem solving, inquiry activities, and small and whole group discussions (along with lecture and teacher demonstration) are frequently used teaching methods for most respondents. Analysis of charts, graphs and maps, of images and animations, discussion of current issues, and use of data are occasionally used teaching methods. Unfortunately, field work at natural sites and service learning/ stewardship activities are currently rarely done except in informal education contexts.
- Supplementary curriculum materials, online materials, textbooks, materials from environmental education centers and interactive websites represent sources for curriculum activities used at least occasionally by all educators.
- A variety of formats for delivering curriculum materials were seen as useful, with kits, CDs/ DVDs, web-

downloadable and print materials viewed as most useful.

Estuarine specific knowledge, teaching preferences, and sources of materials

Having described general teaching methods and preferences, we then turned to those that were more directly estuarine related.

- Teachers overall currently spend an average of between one and three weeks each year teaching about estuaries, though nearly a third of those in schools, and over half of those in informal settings spend more than three weeks each year. Informal educators and those teaching in coastal areas spend somewhat more time teaching about estuaries than do school teachers, or those teaching away from the coasts.
- Teachers rated their own knowledge about a variety of estuarine related topics in the areas of Life sciences, Earth sciences, Physical sciences, Science & research, and Humans & the environment as Moderate to Solid, with school teachers knowing more about physical sciences, and informal educators knowing more about life sciences. Not surprisingly, high school teachers also tend to know more about these topics than do middle or elementary school teachers.
- Across contexts, teachers say the likelihood of their teaching the range of topics listed is nearly 50%, with school teachers more likely than informal educators to teach about scientific methods and research, physical sciences, and Earth sciences; and informal educators more likely to teach about life sciences.
- Specific topics that teachers say they are particularly likely to teach include:
  Life sciences—*Biodiversity and adaptation* and *Nutrient cycles and food webs*;
  Earth sciences—*The water cycle*; *Wetlands, rivers and watersheds*, and *Erosion and sedimentation*;
  Physical sciences—*Physical properties of water*;
  Science/ research—*Experimentation & scientific method* and *Lab or field work techniques*;
  Humans & the environment—*Human impact on the environment*, *Water pollution* and *Conservation*.
- Teachers use a wide variety of websites to gather educational resources about estuaries and coastal issues. In particular, the NOAA Education website is

used by 59% of respondents, with National Geographic, the National Science Teachers Association (NSTA), the US Geological Survey, NASA, and State educational sites all cited by over 40% of respondents.

- NOAA and NERRS curriculum materials are used occasionally by respondents—with 10% or more of respondents saying they've used Project WET Bays & Estuaries, NOAA data sites, NERRS website materials, NOAA Severe Storm Lab materials, EstuaryLive, materials from individual NERRS sites, and the Watersheds & Weather curriculum.

Field work

- School teachers do field work in natural areas with their students an average (median) of 2 times per year, with 21% saying they don't go at all, and the top 25% going only 4 or more times. By contrast, the median number of field work experiences for informal educators is 12 times per year—once a month. Within each context, there are no coastal/ non-coastal differences in the number of field work experiences.
- When educators take their classes into the field, a plurality at all levels spend a whole day doing so. However, a large fraction of middle and high school teachers only spend a single class period doing so.
- When doing field work, the vast majority of respondents say they make observations and most measure or collect data, and analyze or interpret data. There are some differences in types of activities by context and level taught.

Reasons to teach estuarine topics

Helping teachers meet their goals for teaching estuarine topics can increase the likelihood that curriculum materials would be adopted.

- Teachers ranked "Increasing student interest with interdisciplinary and/ or authentic contexts" as the most important reason for adopting supplementary materials from among several choices.
- There are a variety of reasons why teachers might teach a topic. Chief among these is that it meets the requirements of their state or local curriculum or the state standards. Teachers are also very interested in topics that are relevant to the world and their local communities, and that help students understand human impact on the environment and develop into

responsible citizens who can make a difference about important global issues. They want topics that are interesting to students and to themselves, that build on what teachers know, that use hands-on and field/ lab experiences and are integrated across subject areas.

- Many of the reasons teachers might *not* teach about a topic mirror the reasons above. In particular, a huge proportion feel a keen lack of time to add any materials that are not already in the required curriculum, standards or test. Teachers also worry about their own knowledge of a topic, the availability of necessary materials and equipment or funds, and whether the materials are at the appropriate level for their students. Many say they wouldn't teach coastal topics because of their location away from the coast.

Supports and obstacles

- Teachers see their own knowledge—about science content, teaching inquiry science, working with data, and hands-on labs—as a moderate to strong support for adopting new materials. They get substantial support from various people they work with—administrators, colleagues, outside experts, parents, and even students. Issues around technology and equipment are seen as slight supports.
- For all respondents other than informal educators, issues around field work are seen as a slight to moderate obstacle.
- Issues around standards, testing and policy; curriculum; and availability of professional development are, on average, seen as neither an obstacle nor a support.
- There is variation within categories in the degree of support that teachers perceive. There is also variation across groups in these perceptions.

Professional development

- Teachers say that professional development around a wide range of topics would be at least moderately useful. Support for making new curriculum materials relevant to students, integrated into existing curricula/ standards, and incorporating new labs, as well as developing teachers' own science content are rated highest. Middle school teachers expressed special interest in professional development around the use of real-time data, use of visualizations of data, and use of data analysis software.

- Across the board, teachers prefer focused 1-day, or 2- to 3-day workshop professional development opportunities, as well as consulting support over time. Those teaching in schools also see an extended one or more week training as useful.

Recommendations

The TERC/ NERRS Needs Assessment has provided a wide range of information about the state of estuarine education in the U.S. and factors which should be considered in the design of K–12 curriculum materials on estuarine content. A few broad recommendations can be drawn from these data, as well as the many particular suggestions contained herein.

- Interesting curricular materials that focus on important scientific concepts presented in the context of estuaries, and that take a few weeks to complete would likely be attractive to many teachers and are worth developing.
- Materials that include innovative pedagogical techniques such as hands-on and inquiry methods will easily fit within teachers' current practices. Other techniques such as analyses of charts, graphs, maps and images, or use of data would require more curricular or professional development support to be regularly incorporated into classroom practice. Field work and service learning are so infrequently done, or provide such logistical difficulties, that they shouldn't be emphasized in curricular materials, and their use in other programs will require additional support.
- Curriculum materials that focus on interdisciplinary learning opportunities, use authentic contexts that are relevant to local communities, and that support students to understand about human impact on the environment and to develop into responsible citizens who can make a difference about important global issues are especially interesting to teachers. However, materials also need to address state or local curriculum requirements and standards, be interesting, at the appropriate level, and do-able with equipment and materials available in classrooms, and teachers need to understand the content itself, if they are to be adopted. Successful curriculum materials and programs will likely need to reflect and address these interests and concerns.